Installation and Operation of the 1100 Series Micro Valves G1162A and G1163A

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In this note the installation and operation of the Agilent 1100 Series micro valves G1162A and G1163A is described. The micro valves with small internal volumes are designed for LC applications with flow rates in the nl/min and µl/min range.

The 2-position/6-port micro valve G1162A provides a solution for applications as sample enrichment and stripping methods or multidimensional liquid chromatography.

The 2-position/10-port micro valve G1163A provides an elegant way to increase sample throughput by alternating column regeneration.

General Information

System Requirements

The requirements to operate the Agilent 1100 Series micro valves are displayed in Table 1 and Table 2 on this page.

Table 1 Site Requirements for Agilent 1100 Series Micro Valves

Type	Specification
• Weight	• 1.9 Kg (4.2 lbs)
• Dimensions (height x width x depth)	• 92 x 84 x 200 mm • (9.2 x 3.3 x 8.0 inches)
• Power supply	• 24 Volts DC (1.7 amps)
• Ambient operating temperature	• 4 to 55°C (39 to 131°F)
• Humidity	• < 95%, non-condensing

Table 2 Required Firmware and Software Revisions

	Revision
Agilent 1100 Firmware	A.05.04 and higher
Control Module G1323B Firmware	B.03.11 and higher
Agilent ChemStation Software	A.09.03 and higher

The required firmware for the 1100 Series LC modules and the G1323B control module can be downloaded from the Agilent web

http://www.chem.agilent.com/scripts/cag_firmware.asp

The operation of the 1100 Series Micro Valves requires 24 Volts DC power that can be supplied by one of the following 1100 Series modules with DC CAN adapter.

- G1364A Agilent 1100 Series Fraction Collector
- G1367A Agilent 1100 Series Well-Plate Sampler
- G1377A Agilent 1100 Series Micro Well-Plate Sampler

or by an external power supply (0950-4422).

Performance Specifications

Table 3 G1162A 1100 Series 2 position/ 6 port micro valve

Liquid contacts:	DuraLife processed stainless steel (stator) and vespel (rotor seal)
Port size:	Accepts M4 male threaded fittings
Flow passage diameters:	0.20 mm (0.008")
Volume in flow passages:	70 nl port to port
Maximum pressure:	41 MPa (408 bar, 6000 psi)

Table 4 G1163A 1100 Series 2 position/ 10 port micro valve

Liquid contacts:	DuraLife processed stainless steel (stator) and vespel (rotor seal)
Port size:	Accepts M4 male threaded fittings
Flow passage diameters:	0.20 mm (0.008")
Volume in flow passages:	Stator (20° ports)27.2 nl, (45° ports) 30.5 nl, rotor seal 25.0 nl/groove
Maximum pressure:	41 MPa (408 bar, 6000 psi)

Damaged Packaging

If the delivery packaging shows signs of external damage, please call your Agilent Technologies sales and service office immediately. Inform your service representative that the 1100 Series micro valve may have been damaged during shipment.

CAUTION If there are signs of damage, please do not attempt to install the valve

Delivery Checklist

Make sure all parts and materials have been delivered. The delivery checklist is shown in Table 5. Please report missing or damaged parts to your local Agilent Technologies sales and service office.

Table 5 Delivery checklist for Agilent 1100 Series micro valves

Quantity	Description	Part Number
1	1100 Series Valve	
1	Declaration of conformity	
1	Rail assembly for Column Organizer	5065-4450
6/10	M4 micro valve fittings	5022-2186
1	M4 micro valve plugs	5022-2187
1	**Accessory kit containing**	
1	CAN Cable, 1m long	5181-1519
1	DC-CAN cable	5181-1533
1	Rheotool socket wrench	8710-2391
1	Hex Key, 9/64" T-handle	8710-2394
1	Hex Key, 5/64"	
1	Wrench	8710-0510
1	Technical Note	

The M4 micro valve fittings support the Agilent PEEK coated fused silica capillaries (O.D. 0.8 mm or 1/32"). The M4 micro valve plugs are supplied for pressure (leak) testing.

For a list of the recommended Agilent PEEK coated fused silica capillaries can be found under "Capillaries and Fittings" on page 13.

Hardware Installation

The Agilent 1100 Series Micro Valves can be installed in two different ways. They can either be placed on free bench space near the Agilent 1100 Series HPLC system or they can be mounted on the Agilent G1383A Column Organizer. The column organizer should be located on the right side of the 1100 Series stack, which includes the autosampler.

In order to install a valve on the G1383A Column Organizer the Organizer Rail Assembly must be installed on the two mounting poles using the clips from the Organizer Rail Assembly. All Micro Valves have a bracket on the side which slides over the metal part of the Organizer Rail Assembly. This bracket can be mounted on either side of the valve.

Two CAN connectors and one DC-CAN connector are located at the back panel of the 1100 Series Valve Assemblies as displayed in Figure 1.

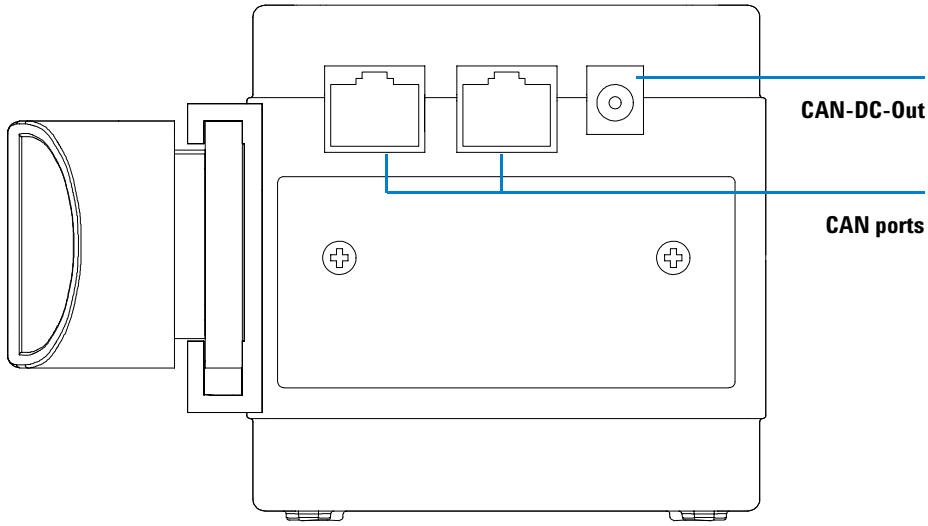


Figure 1 Back Panel of the Agilent 1100 Series Valves

Setting up the CAN connection

Connect the CAN-Cable (PN 5181-1519) to one of the CAN ports at back panel of the 1100 Series valve and to a free CAN-Port on another Agilent 1100 Series module. The second CAN-Port can be used to add additional valves or modules to the HPLC system.

Setting up the power connection to other Agilent 1100 Series Modules

The power for the Agilent 1100 Series External Valves can be supplied by one of the following 1100 Series modules:

- **G1364A Agilent 1100 Series Fraction Collector**
- **G1367A Agilent 1100 Series Well-Plate Autosampler**
- **G1377A Agilent 1100 Series Micro Well-Plate Autosampler**

Connect the DC-CAN Cable (PN 5181-1533) to the DC-CAN connector at the back panel of the valve and to the DC-CAN connector on one of the Agilent 1100 Series modules listed above.

Setting up the power connection to the external power supply

If none of the Agilent 1100 Series modules from the list above is part of your HPLC system, you have to supply the power through an external power supply (P/N 0950-4422). Plug the DC-CAN adapter from the power supply into the DC-CAN connector on the back panel of your 1100 Series Micro Valve.

Software Configuration

The 1100 Series Valves can be controlled by the Agilent ChemStation Rev. A.09.03 or higher.

To configure the 1100 Series Valves

Step		Note
1	Start the Agilent ChemStation Software.	
2	Select **Configure 1100 Access** in the **Instrument** menu.	
3	In the upcoming **Configuration** dialog box select one or multiple valves and click **Add.**	The selected green valve icon now moves from the left **Available Modules** panel to the right **Configured Modules.**
4	Click **OK** to leave the Configuration dialog box.	
5	After a **Restart** the Agilent ChemStation Software a new menu item **Setup Valve** now appears in the **Instrument** menu.	

Operation

Operating the Valve using the Agilent ChemStation

After the Agilent 1100 Series Valves have been installed and configured, the valve parameters can be edited in the Agilent ChemStation. Choose **Setup Valve** from the **Instrument** menu to open the valve dialog box as displayed in Figure 2.

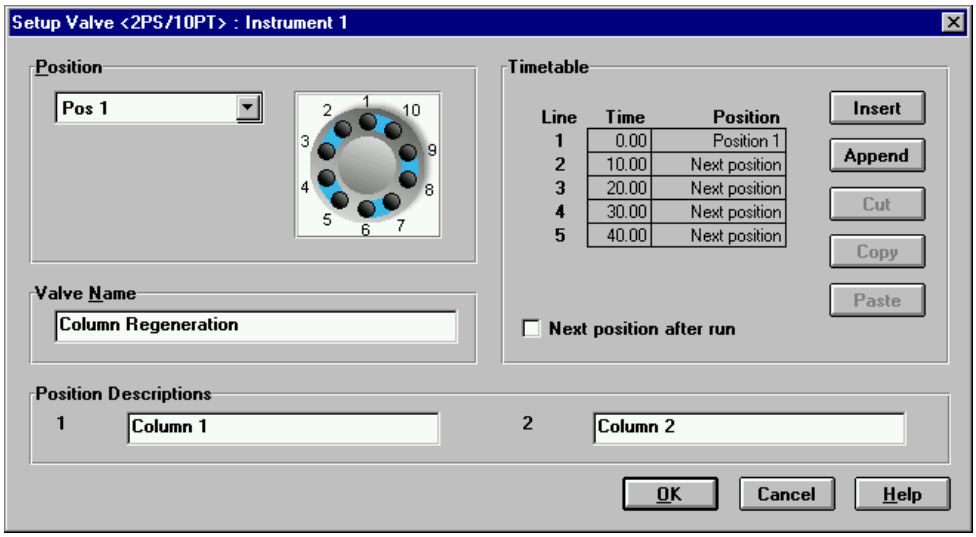


Figure 2 Valve Setup dialog box

NOTE The example displays the valve setup for the 2 position/10 port valve (G1163A). The interface for the other valves are similar.

Position

When loading a method the valve is switched to the position, that is displayed in the **Position** dropdown box. If you select **Use Current**, the valve remains in the current position, when a new method is loaded.

If you select a new position in the dropdown box and click **OK**, the Setup Valve dialog box will be closed and the valve switches to the new position.

Valve Name

Define the **Valve Name** that is used for the method report and the **Instrument actuals**. The **Valve Name** is limited to 20 characters.

Position Descriptions

Define the **Position Description** that is used for the method report and the instrument actuals. The Position Description is limited to 19 characters.

Time Table

The **Time Table** can be used to edit and run a valve program during a sequence of sample runs. The Time Table contains 3 columns (**Line, Time and Position**). The Time Table is limited to 20 lines. The number of selection in the Position column depends on the valve that has been configured.

Position X	switches the valve to the selected position.
Next Position	switches to the next available position. If the valve is on the highest position it will switch to position 1.
Insert	Inserts a line in the **Time Table** above the selected position.
Append	Appends a line at the end of the **Time Table**.
Cut	Cuts the selected line(s) out of the **Time Table** and saves it to the clipboard.
Copy	Copies the selected line(s) from the table to the clipboard.
Paste	Pastes line(s) from the Clipboard to the **Time Table**.

Next position after run

If **Next position after run** is checked, the valve will switch to the next available position after the run is completed. You also have to select **Use Current** in the position dropdown list, otherwise the position defined in the **Position** dropdown list will overwrite the setting in the time table.

Display instrument actuals

In order to display the current status of your 1100 Series Micro Valve choose **Instrument Actuals** form the **View** menu in the Agilent ChemStation to open the Valve Status dialog box.

Handheld Controller Functions

With firmware revision B.03.11 or higher the following valve functions with the Agilent 1100 Series handheld controller G1323B are available. Complete control of an 1100 Series Valve during an LC analysis requires ChemStation Revision A.09.03 or higher.

Switching the Valve

1 From the startup screen of the 1100 Series Handheld Control Module select **System (F5)**

2 Select **Control (F5)** and then **Valve** to open the Valve Control screen. Use the arrow keys (up and down) to switch the valve to the next position.

Valve Synchronization

1 From the startup screen of the 1100 Series Handheld Control Module select **System (F5)**

2 Select **Tests (F3)** and **Valve** to open the Synchronization screen.

3 Press **Synchronize (F7)** and select the position for the valve synchronization.

Setting the EMF limit and switch counter

1 From the startup screen of the Agilent 1100 Series Handheld Control Module select **System (F5)**

2 Select **Records (F4)** and scroll through the displayed module list and select the Agilent 1100 Series Valve.

3 Press **EMF (F1)** and then select **1 Setup Limits.**

4 In the upcoming dialog (Figure 3) edit the EMF limit. If this limiting number of switches has been reached, you will get an `Early Maintenance Feedback` signal on your Handheld controller and in the Graphical User Interface of the Agilent ChemStation Software. After you have done an maintenance action, press **Reset (F7)** to reset the switch counter.

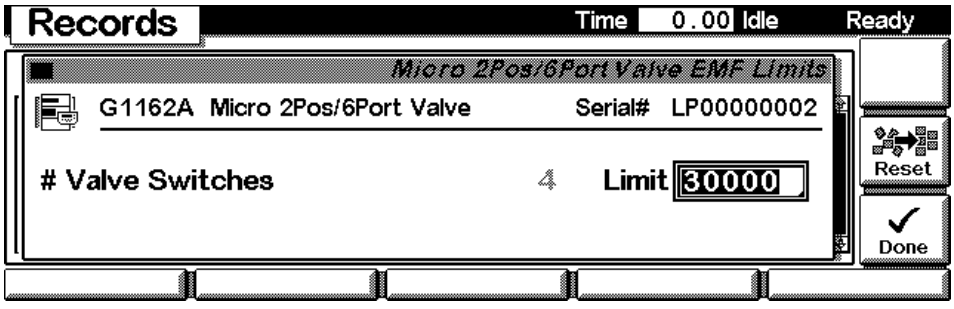


Figure 3 Early Maintenance Feedback (EMF) Screen

Maintenance and Repair

Agilent Technologies recommends to exchange the rotor seal of the micro valves regularly in order to avoid leaks or carryover.

In addition it might be necessary to exchange the stator head, if the threads are worn out or if a fitting is broken and cannot be removed from the stator head. Part numbers of the rotor seals and stator heads are listed in Table 6.

CAUTION Always rinse the valve with water after using aqueous buffers or salt solutions to prevent crystal formation which may damage the valve.

Replacing the stator face and the rotor seal

Disassembling the valve head

1. Use the Hex Key to remove the Stator Screws from the Stator Head.
2. Disassemble the Stator Head and the Stator Ring.
3. Remove the Rotor Seal from the Valve Body. The Rotor Seal is mounted on three pins, and can be pulled off.

Reassembling the valve head

1. Mount the new Rotor Seal with the grooves facing the Stator Head. The three pins on the Shaft Assembly fit into the matching holes in the Rotor Seal only one way.
2. Mount the Stator Ring on the Shaft Assembly that the two pins fit to the matching holes on the Valve body.
3. Assemble the Stator Head that the pin in the Stator Ring fits to the matching hole in the Stator Head.
4. Insert the Stator Screws. Turn each of the screws an equal amount until the they are finger-tight, then tighten them another half turn.

Table 6 Repair parts for Agilent 1100 Series Micro Valves

Description		part number
• Rotor seals (vespel)	• Rotor seal for G1162A (2 position/6 port valve)	• 0100-2087
	• Rotor seal for G1163A (2 position/10 port valve)	• 0101-1361
• Stator heads	• Stator head for G1162A (2 position/6 port valve)	• 0100-2089
	• Stator head for G1163A (2 position/10 port valve)	• 0101-1363

Early Maintenance Feedback (EMF)

Depending on the application the valve will perform many thousands of actuations without any visible signs of wear. In order to minimize downtime the Agilent ChemStation offers *Early Maintenance Feedback (EMF)* for the 1100 Series Valves. EMF monitors the number of switches of the 1100 Series valves, and provides feedback when a user-selectable limit is exceeded. The visual feedback in the graphical user interface provides an indication, that the exchange of the stator face and/or the rotor seal should be scheduled.

In the **Diagnostics** view you can define, after how many valve switches the stator face and/or the rotor seal should be replaced. The setting for the EMF limit depends on analytical conditions, e.g. use of buffer solutions. Hence the setting should be optimized over one or two maintenance cycles.

Setting the EMF limit

1 Switch to the **Diagnostics** View of the ChemStation.

2 Click on the **EMF** icon. The **EMF Info Pad** will appear on the right panel of the user interface.

3 Select a valve on the dropdown list of the **EMF Info Pad.**

4 Enter the EMF limit and click on the **Send Changes** button.

Resetting the EMF counter

1 Switch to the **Diagnostics** View of the ChemStation.

2 Select **Valve** from the **Maintenance** menu.

3 In the upcoming dialog box click on **Reset Counter** (Figure 4).

The procedure to reset the EMF counter with the 1100 Series handheld controller is described on page 10.

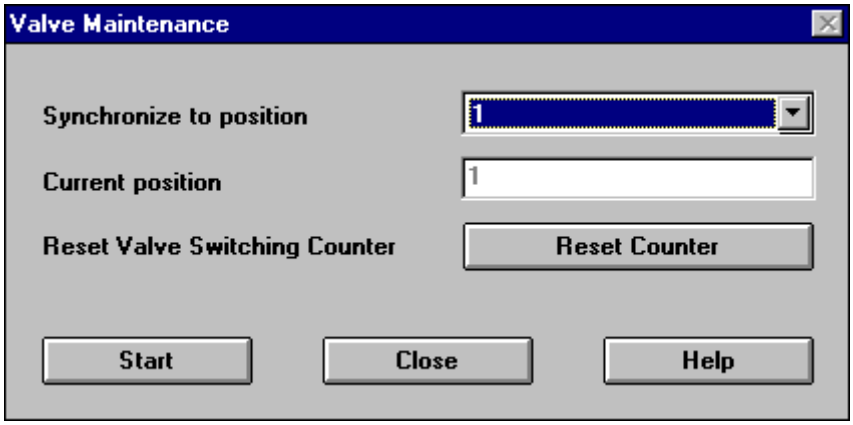


Figure 4 Valve Maintenance dialog box

Capillaries and Fittings

For the operation of the Agilent 1100 Series Micro Valves we recommend the following fittings and PEEK coated fused silica capillaries as listed in Table 7, Table 8 and Table 9 on page 14.

Table 7 Fittings and ferrules

Fitting Type	Name	Description	Conditioning	Part number
A	Swagelok	1/16″ SST fitting, front and back ferrule	10/pk	5062-2418
B	Lite Touch	1/16″ SST fitting male, wrench size 4	10/pk	5063-6593
B	Lite Touch	1/32″ SST ferrule and lock ring	10/pk	5065-4423
C	Rheodyne	M4 PEEK fitting	6 fitt/2 plug	5065-4410
D	Finger Tight	Double winged nuts and 1/32″ ferrules	10/pk	5065-4422
E	Lite touch Detector	1/16″ SST fitting male, wrench size 4	10/pk	5063-6593
E	Lite touch Detector	SST ferrule	10/pk	5063-6592
E	Lite touch Detector	PEEK sleeve	1/pk	5042-1396

Table 8 Fitting types

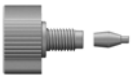
Fittings and ferrules	Fitting type
	A
	B
	C
	D

Table 9 Peek coated fused silica capillaries for micro valves

i.D./µm	Length/mm	Volume/µl	Fitting type*	Part number
100	150	1.178	B/C	G1375-87317
100	200	1.570	B/C	G1375-87312
100	220	1.728	B/B	G1375-87305
100	550	4.320	B/C	G1375-87306
100	1100	8.639	B/D	G1375-87315
100	1100	8.639	B/B	G1375-87303
75	400	1.767	D/E	G1375-87308
75	500	3.209	C/D	G1375-87311
75	700	3.092	E/-	G1315-68708
50	150	0.295	B/C	G1375-87300
50	200	0.392	B/C	G1375-87302
50	220	0.432	B/B	G1375-87301
50	280	0.550	C/D	G1375-87309
50	400	0.785	E/D	G1315-68703
50	500	0.982	C/D	G1375-87304
50	550	1.080	B/C	G1375-87310
25	100	0.049	C/D	G1375-87320
25	220	0.108	D/D	G1375-87321
25	350	0.172	C/D	G1375-87322
25	550	0.270	C/D	G1375-87323
25	700	0.344	C/D	G1375-87324

* see Table 8 on page 13

Instructions to connect a capillary.

With Swagelok fitting (type A)

- Slide the nut, the compression ring and the ferrule onto the tubing.
- Insert into the receiving port and finger tighten the fitting into the port.
- Using a 1/4 inch wrench tighten the fitting 3/4 wrench turn.

With Rheodyne fitting (type C).

- Slide the fitting on the capillary.
- Insert into the receiving port, and finger tighten the fitting into the port.
- Using a 1/4 inch wrench tighten the fitting 1/4 wrench turn.

CAUTION Do not overtighten PEEK fittings!

With Lite Touch fitting (type B or E)

NOTE The Lite Touch ferrule System may be used with any stainless steel nut, or corresponding Lite Touch nut.

- Slide the nut, steel compression ring and PEEK ferrules, (in that order), onto the tubing. The flattened end of the ring should face towards the nut with the narrower end of the ferrule toward the ring.
- Insert into the receiving port. Hold the tubing to the bottom of the fitting while tightening down the nut. Tighten comfortably finger-tight.
- Using a 4 mm wrench tighten the stainless steel nut down with a 1/4 wrench turn.

With finger tight fitting (type D).

- Slide fitting and ferrule onto the tubing.
- Insert it into the receiving port and finger tighten the nut until snug.

Hints for Successful use of Capillaries and Fittings

- Never overtighten a fitting.
- Never cut a capillary
- Take care when you bend a capillary (diameter never below 40 mm).
- Avoid the use of alkaline solutions (pH > 8.5) which can attack the fused silica from the capillaries.
- When connecting, press the capillary smoothly into the fitting to avoid air gaps.
- If a capillary leaks, never retighten it under flow.
- A blocked capillary can often be cleaned by flushing it back. Acetone is recommended for this.
- Take care when applying module doors, not to crush capillaries.
- A broken capillary can release silica particles in the system.

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